DOCUMENT RESUME

ED 153 847 SE 024 174

AUTHOR White, Edwin P.
TITLE Status of Elementary Science in the Commonwealth of Virginia.
PUB DATE 11 May 78
NOTE 22p.; Paper presented at the Virginia Academy of Science, Virginia Polytechnic Institute & State University, Blacksburg, Virginia; Contains occasional light and broken type

EDRS PRICE MF-$0.83 HC-$1.67 Plus Postage.
DESCRIPTORS *Achievement; *Curriculum; *Educational Innovation; Educational Research; Elementary Education; *Elementary School Science; Instruction; *Program Evaluation
IDENTIFIERS Research Reports; *Virginia

ABSTRACT

Presented is a report reviewing and evaluating the status of elementary science education in the state of Virginia. The report addresses the questions of: (1) What patterns can be observed from the adoption, by local schools, of elementary science programs? (2) What do standardized tests tell about elementary students' learning in science? (3) What has been the effect of adopting elementary science accreditation standards? and, (4) What future activities are planned for elementary science in Virginia? (SL)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED153847

U S DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

Edwin White

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) AND USERS OF THE ERIC SYSTEM."

STATUS OF ELEMENTARY SCIENCE IN THE COMMONWEALTH OF VIRGINIA

Presented at the
VIRGINIA ACADEMY OF SCIENCE
Virginia Polytechnic Institute &
State University
Blacksburg, Virginia

May 11, 1978

Dr. Edwin P. White
Supervisor of Science Education
Division of Sciences and Elementary Administration
Virginia Department of Education

SE 024 174

Introduction:

This report is based on my observations and analysis of data collected over the past six years, as the person having the major responsibility for elementary science at the state level. Many of these observations are highly subjective, since no other data was available other than my opinions, observations, and inferences. The reader is cautioned to view these data (numerical and observational) with this obvious limitation in mind. Additional data collection procedures are in development or have been proposed from which a more objective viewpoint can be established for future reports.

Historical Background:

For a report to be useful, it needs to be set into perspective of the major events that may have had some impact on the interpretation of these data reported. This section will briefly highlight, based on the presentor's opinion, significant events in elementary science in Virginia. The Virginia Department of Education was one of the first State Education Agencies (SEA's) to provide science supervisory assistance to local education agencies (LEA's) in the 1950's. Many of these individuals were primarily concerned with procurement of science equipment through NDEA. They did, however, provide extensive advisory service to secondary science programs. The general education staff of the Elementary Education Service provided general assistance for elementary science including, in 1965, a series of regional meetings on elementary science.

In 1969 the Board of Education, in response to an increasing level of requests for assistance, created the position of Assistant Supervisor-Elementary Science in the Elementary Education Service. This position provided additional assistance and leadership to the emerging area of elementary

science. One of the major responsibilities of this position was the development of the Elementary Science Guide, K-7, published in 1972. Over 30,000 copies of this guide have been distributed to classroom teachers in Virginia. In 1974 the Environmental Education Guide, K-12 was distributed which continued the emphasis on process skill development first outlined in the elementary science guide.

In 1974 the Division of Elementary Education was granted funds by the National Science Foundation to conduct leadership training activities in the area of elementary science. The workshops funded by this grant were especially important to the subsequent adoption of elementary science materials in 1975 by local school divisions. Over 80 percent (108 divisions) of the LEA's in Virginia participated in the NSF grant.

Two major events occurred in 1976 of importance to the status of elementary science. The first was the upgrading of the position, Assistant Supervisor-Elementary Science to Supervisor of Elementary Science. This action by the Board of Education provided professional equality between personnel in elementary and secondary science. The second major advance was the inclusion of four science standards in the publication, Standards for Accrediting Elementary Schools in Virginia. These standards, along with other areas as well, represent the first effort to base accreditation on the quality of the instructional program.

During 1977, the Division of Elementary Education funded a committee to develop elementary science program goals and objectives. These goals and objectives are currently being printed and will be distributed during the 1978-79 school year. In July (1977) the Department of Education was reorganized to bring elementary and secondary science into a single Science Education Service, K-12 within the Division of Sciences and Elementary Administration. This organization structure is too new, at this time, to report any

changes other than that a K-12 perspective will represent a different orientation to providing service to LEA's. All of this historical background has been provided as a backdrop against which to assess the current status and predict future directions for elementary science.

The body of this report will deal with the following questions and attempt to provide some answers and recommendations.

1. What patterns can be observed from the adoptions by local school divisions of elementary science programs?
2. What do data from standardized tests tell us about what elementary students are learning in science? (SRA and NAEP)
3. What has the effect been of the adoption of elementary science accreditation standards?
4. What future activities are planned for elementary science by the Science Education Service, Virginia Department of Education?

---

1. What patterns can be observed from the adoptions by local school divisions of elementary science programs?

The most recent elementary science adoption took place July 1, 1975, almost three years ago. No textbooks or programs were submitted for the interim adoption in 1977. The 1975 adoption (Board action was official in December, 1974) of elementary science materials marked a significant change for Virginia in regards to the type of materials officially approved by the Board of Education. For the first time, non-textbook, activity-centered, process programs were adopted. Prior to this action all adopted materials had been restricted to the textbook-based format. The acceptance of the NSF programs (ESS, SCIS, SAPA) in Virginia was a first for one of the textbook adoption states (N=26). The approval of these materials was as important politically as it was instructionally. For example, other subject matter specialists at the state level have used the science adoption as setting a valuable precedent for them to justify consideration of multimedia instructional materials in their own area. In addition, the Board

also approved other materials that represented the complete spectrum of programs. Thirty-three programs were submitted for adoption, resulting in an approved list of eleven textbook series and programs (K-6).

Table 1 provides data indicating the number of students and percentage that those students represent whose school division adopted a specific elementary science program. I must caution the reader that these figures are based on data reported by LEA's to the State and, thus, represent "paper adoptions." There is no data to indicate level of purchase or extent of implementation. This type of limitation is common to all data reporting level of usage of instructional materials, since it is physically impossible to get accurate data on a large sample relating to level of implementation. These data, despite its obvious limitation, do provide an opportunity to make comparisons with similar data from other states.

The Michigan Science Teachers Association (1976), for example, reported that 35% of their schools were utilizing NSF programs (SAPA - 13%, ESS - 4%, and SCIS - 18%).[1] They did not report the percentage of students that these schools represent. In Virginia the percentage of schools who utilize NSF materials is 27% (SAPA - 7%, ESS - 16%, and SCIS - 7%)[2]. However, these schools account of 35% of the student (K-6) population.

---

1. Elementary Science Survey, Michigan Science Teachers Association, 1976, (Memorandum, p. 1).
2. Data collected from records of School Libraries and Textbook Service, Virginia Department of Education.

Table 1

Virginia Elementary Science Adoptions

Program	# of students (K-6)	Percentage
Elementary Science Study (ESS)	104,530	20%
Science - A Process Approach (I) (SAPA)	41,805	8%
Science Curriculum Improvement Study (SCIS)	35,185	7%
Total, NSF Programs	181,520	35%
Elementary Science: Learning by Investigating (ESLI)	38,896	7%
Modular Activities Program in Science (MAPS)	66,510	13%
People/Concepts/Processes (PCP)	4,444	1%
Space, Time, Energy, and Matter (STEM)	41,111	8%
Total, second generation programs	150,961	29%
Combined NSF and second Generation Programs	332,481	64%
Concepts in Science (CIS)	77,089	15%
Ginn Science Program (GSP)	4,685	1%
Science: Understanding Your Environment (SUYE)	97,096	18%
Total, concept/content program	178,870	34%
Discovering Science	6,713	1%
The Young Scientist	12,493	2%
Total, content programs	19,206	4%

This analysis is based on 1977-78 (K-6) student enrollment and elementary science adoptions (July, 1975). No attempt should be made to infer implementation percentages from these adoption data.

Delaware (1974) reported that 25% of their schools were utilizing SAPA (35% in K-3, 12% in 4-6). ESS and SCIS were reported at less than one percent each.[3]

In 1973 a study of science teaching practices in Pennsylvania reported that in "at least one classroom/school" the NSF programs were utilized in the following levels.[4]

SAPA - 19%

SCIS - 12%

ESS - 14%

Webb reported in 1972 that in the southeastern states (south of Washington, D.C.) 8.4% of the schools were using SAPA, 2.2 were using ESS, and 1.1% SCIS. For the Plains Regions the percentages were SAPA - 10.5%, ESS - 13.7%, SCIS - 4.7%. The Rocky Mountain Regions reported 4.2% SAPA, 13.3% ESS, 6.6% SCIS.[5]

Maben, who researched the Far West and Great Lakes Regions reported the following data:[6]

	SAPA	ESS	SCIS
Great Lakes	5.7	3.2	1.9
Far West	7.2	5.0	2.7

---

3. The Status of Science Teaching in Delaware (1974) Delaware Department of Public Instruction, Dover, Delaware 19901.
4. Bellucci, Joseph T., Science Teaching in Pennsylvania Public Elementary Schools, Wilkes College, Wilkes-Barre, PA, 1973, p. 11.
5. Webb, Melvin, Teaching Science in Public Elementary Schools of the Plains, Rocky Mountain, and Southwest Regions of the United States, Unpublished Dissertation, The Ohio State University, 1972, p. 159.
6. Maben, Jerrold, A Survey of Science Teaching in the Public Elementary Schools of the Far West and Great Lakes of the United States During the 1970-71 School Year, Bureau of Education Grants, City University of New York, 1973, p. 205.

A study of elementary science in Massachusetts revealed that 13% (78,000) of the student population (1972-73) were utilizing ESS, SCIS, or SAPA.[7] Pinck compared this percentage of 13% (MA) to the 4.6% utilization on a national basis.

Almost all of these data on other states or regions are now 5-8 years old and collected in numerous and possibly incompatible ways. These data do, however, provide the best basis possible for generating discussion in respect to the current use of NSF programs in Virginia.

Having reported all of these data, it seems apparent the comparisons to Virginia data will provide the beginnings of a "where we are now" discussion. The most striking comparisons exist between the Southeast regional data (Webb) and the national average reported by Pinck (MA Study).

Webb (1972)	8.4% of schools utilize NSF programs in Southeast
Pinck (1973)	4.6% of schools utilize on a national basis

The current data for Virginia indicates that 27% of the elementary schools are using one or more of the NSF programs. Prior to the official adoption of ESS, SCIS, and SAPA in Virginia, the percentage was estimated between 10% and 15%. Without question, the reader is again cautioned not to view these percentages as completely accurate for the reasons already stated. One can, however, see that there exists a pattern of increased utilization. Compared to these data collected by Webb and Pinck, utilization has increased by a factor of 5-7. Contrasting the pre-adoption estimate (Virginia-1974) and current usage has increased 2-3 times. When looking at the individual NSF programs, there appears to be more use of ESS in Virginia than on a national

---

7. Pinck, Dan C., Something of Value, Harvard University, Cambridge, MA, 1973, p. 4.

level.

In Virginia these data indicate that ESS is used twice as often (16% of schools) when compared to SAPA (7% of schools) and SCIS (7% of schools). This preference for ESS is even more clearly seen when one examines the number of students using each program.

ESS	104,530 students	20% total population
SAPA	41,805 students	8% total population
SCIS	35,185 students	7% total population
	181,520 students	35% total population

Of the number of students using any one of the NSF programs, 58% are identified with the Elementary Science Study (ESS) program. These data clearly indicate an increase usage of the NSF programs with ESS being the most commonly chosen program.

In examining the current status of the programs in use in Virginia, one must look at the selection of textbook-based programs which have been highly influenced by the NSF programs. In figure 1, these programs are referred to as "second generation elementary science programs." The programs were developed by the private sector, but were strongly influenced by the NSF funded programs. The philosophy, objectives, and teaching strategies are very similar to the NSF programs, but are presented in a textbook format.

These data show that 150,961 students (29%) utilized one of the second generation programs. Three programs, MAPS, STEM, and ESLI, account for about 98% of this category. When these data between these first two groupings (figure I) are combined, approximately 64% of the student population (K-6) is accounted for. This represents a significant portion of the student population who are being exposed to some form of "hands on process science" indicating general acceptance of this type of instructional strategy.

There are some additional data that can be generated from the information on local school division elementary science adoptions:

-County school divisions tend to adopt concept/content or content programs (53.4% of adoptions) but which only account for 38% of the total student population.

-The Silver Burdett and Harcourt Brace Jovanivich textbook programs were adopted by 94 of the 140 school divisions, but these only account for 33% of the student population in Virginia.

-School divisions with a science supervisor (K-12, K-6, or 7-12) tend to adopt the NSF or second generation programs.

A final concern of this section deals with implementation of these programs. The answer is simply - NO HARD DATA EXISTS FOR VIRGINIA. Presently, there is no acceptable set of data, either for Virginia or the nation, to indicate the level of actual use of any of these programs. We can, however, report on personal observations to provide a reference point. During the last three years, I have visited over 90 of the 140 school divisions in Virginia. Interactions with central office personnel, principals, teachers, and observations in elementary classrooms urge me to report the following subjective generalizations:

1. In school divisions who adopt an NSF type program more actual usage occurs in the classrooms than in divisions which adopt other types of programs.

2. More time and money is allocated to elementary science by those divisions who adopt the NSF type programs.

3. More LEA's who have adopted an NSF type program request assistance from the Science Education Service than other divisions.

4. In-service time for elementary science is more common in the division who has adopted an activity-centered program than those who adopted a content type program.

2. What do data from standardized tests tell us about what elementary students are learning in science?

Regardless of our perceived worth of standardized tests, the use of them continues in Virginia at varying degrees each year. This report is not charged with discussing the pros and cons of such tests, but only reporting what data exists. Therefore, the question of importance is: "What does this data tell us about what children are learning or are not learning based on the limitations of the tests utilized?" Table 2 presents the available data on science from 1972 to present for grades 4, 6, 8, and 11. The percentile for the Short Test of Educational Avility (STEA) is also given. Of major concern to this report are the 4th and 6th grade scores.

The pattern for Virginia in the area has been one of gradual increases of the elementary science scores. The 4th grade scores have risen from the 44 to the 56 percentile in the past six years of testing. The STEA scores have also increased, but not at the same rate. These data have severe limitations and about the only generalization one can make is that 4th and 6th grade children in Virginia are currently achieving (as measured by this test) at about the 50 percentile.

Additional data from the SRA tests can be examined which include an item analysis of the science test questions. The 4th (1976-77 and 1977-78) and 6th (1976-77) data can be broken out into five skill clusters: Living Things, Matter and Energy, Earth and Space, Experimentation, and Charts and Tables. These data are presented in Table 3. Again, keeping in mind the limitations of the SRA or any other standardized test, one can make the following observations:

1. Students answer correctly (%) more of the questions related to the Charts and Tables cluster (54-56%) than in other clusters.
2. Fewest correct responses (%) are found in the area of experimentation (29-47%) cluster.

TABLE 2

SRA Science Percentile
Virginia

Year	STEA 4th	Science 4th	STEA 6th	Science 6th	STEA 8th	Science 8th	STEA 11th	Science 11th		
72-73	41	44	42	46	---	---	41	45		
73-74	35	45	42	42	37	36	41	43		
74-75	44	51	44	48	41	42	42	36		
75-76	44	51	44	48	39	42	42	36		
76-77	49	51	47	48	41	42	42	36		
77-78	49	56	---	---	38	42	---	---		

TABLE 3

SRA Science Skill Clusters

	4th 1976-77	6th 1976-77	4th 1977-78
Living Things	48% (1) (10) (2)	49% (11)	49% (10)
Matter & Energy	44% (10)	46% (10)	44% (10)
Earth & Space	38% (9)	43% (8)	38% (9)
Experimentation	29% (5)	47% (5)	29% (5)
Charts & Tables	54% (6)	56% (6)	54% (6)

Note: 6th grade not tested in 1977-78

(1) Percentage of questions answered correctly.

(2) Number of questions (n=40)

3. Sixth grade students answer correctly more questions in each cluster than do fourth graders.

4. The only significant change between 4th and 6th grade appears in the experimentation cluster.

The major point from examining these data is the low percentage of correct responses for the experimentation cluster. One has to be careful however, since there are only five questions in this cluster. There might also be a readability or conceptual level problem as well. Certainly, additional data is needed to verify this concern, but is does warrant continued monitoring.

Each of 4th and 6th grade science (SRA) tests have forty (40) questions. Twenty of the questions in the 4th grade test also appear on the 6th grade test, providing additional comparisons. Table 4 provides the data for the twenty common questions from the 4th and 6th grade test (1976-77).

TABLE 4

1976-77 SRA Science Clusters[1]

	4th	6th
Living Things	40%	61%
Matter & Energy	31%	49%
Earth & Space	35%	52%
Experimentation	29%	47%
Charts & Tables	54%	56%

Ability scores (STEA) held constant.

In four of the science clusters (excluding Charts & Tables) these data indicate a significant increase in the percentage of correct responses from 4th to 6th grade. Of particular concern, however, is the lower percentage for the skill clusters of; Matter and Energy (49%) and Experimentation (47%).

The Matter and Energy skill cluster is important, because of its potential realtionship to environmental education and the current energy concerns. The Experiementation skill cluster is also important, because it relates to the basic concept of what the elementary science program ought to be in Virginia. In both of these clusters additional work needs to be carried out to eliminate intervening factors such as; reading level, small number of questions, scope and sequence within school divisions, and amount of instructional time. Use of item analysis data at the school division level should also be considered valuable in the program planning process. State data has far too many uncontrolled variables to provide sufficient direction to LEA's when used by itself.

Since 1969, the National Assessment of Educational Progress has attempted to generate data on achievement of students. In 1969 and again in 1973, instruments were developed to measure progress in science across the nation. The NAEP tests suffer the same problems as all other standardized tests, so again we must examine those data with many built in limitations. Essentially, a comparison of the 1969 to the 1973 tests indicate a decline in science scores. However, in the Southeast the decline was smallest and for nine-year old students the gap between the national norm was reduced considerably. (National Assessment of Science, 1969-73, p. 8-9).

Data are not available on a state-by-state basis so the best that can be done is to identify patterns. In regards to the scores of males and females, there was a similar decline among both groups. Females continue to score 4-5% lower than males with the largest discrepancy occurring between the 17 year old students. The differences between the performance of black and white students remained fairly constant averaging between 12-18% depending on the age group.

3. What has the effect been of the adoption of elementary science accreditation standards?

In July, 1976, the Board of Education approved a revised set of standards to be the basis for the accreditation of elementary schools in Virginia. Included for the first time were standards specifically dealing with eight instructional program areas. There are: art, health, language arts, music, mathematics, physical education, science, and social studies.

The standards for elementary science are:

1. Clearly defined objectives shall be established for the science program.

2. The program shall be planned to include the acquisition of factual knowledge and the sequential development of concepts, skills, and values.

3. The program shall include the social, physical, and biological aspects of science.

4. The program shall be designed to develop process skills of observing, defining, classifying, communicating, measuring, inferring, predicting, experimenting, questioning, hypothesizing, interpreting, and generalizing.

These standards were designed to set the parameters of elementary science. They were developed with input from elementary principals and other LEA personnel. The Elementary Science Guide, K-7 and Standards of Quality, 1976-78 served as the initial framework for all of the standards. The attempt was to provide direction, but not to be totally perscriptive. In the first year of reporting (1976-77), fourteen schools (n=1208) reported a total of 44 deficiencies (n=4832). This means that less than 1% of the elementary schools in Virginia reported that they could not meet one or more of these standards. A quick trip through most any school would raise many questions about the validity of the system which produced these data.

In 1977-78 school year, there were no deficiencies reported by any elementary school in Virginia. We could thus conclude that all schools are

teaching the process skills identified in standard No. 4. Obviously, this type of self-reporting system has problems. Principals are responding to the standards from a very sensitive and difficult positions. To admit weakness in any program raises questions of competency, leadership skill, and the efficient utilizations of resources. As a result, these are serious questions concerning the accuracy of these data.

In 1976-77, letters were sent to each of the fourteen schools who had a deficiency on one or more of the science standards offering the assistance of the science staff. Not one responded or requested for assistance. This year all schools said "yes" to each standard. To assist principals in more accurately assessing their program, a set of resource materials, including an assessment instrument, has been developed. Hopefully, this will assist schools to more accurately assess their elementary science programs in relation to the accreditation standards. Indeed, a sign of hope might be derived by the comments of an elementary principal who admitted that his accreditation report was inaccurate, but that he and the staff were working on program development so that by next year the answers on the accreditation report would be accurate and truthful.

If we had sufficient staff to monitor and visit each elementary school possible, the standards could be more effective in improving instructional programs. Currently, however, we do not have, nor does the future look promising that we will have, the necessary funds or human resources to adequately assess the implement of the elementary science accreditation standards. Part of the answer lies in the decision as to how "regulatory" should the Department of Education be, which is currently a question of considerable debate.

4. What future activities are planned for elementary science by the Science Education Service, Virginia Department of Education?

The recent reorganization of the Virginia Department of Education is still in an evolving stage and many decisions are in flux at the present time. It does appear that greater efforts on a K-12 basis will be forthcoming. One example, might be a K-12 set of program goals and objectives for science education. Another might be the expansion of the Earth Science Communications Network to include elementary science. These examples are not firm yet, but the following activities have been included in the proposed service budget for 1978-79.

1. Conduct Annual Elementary Science Conference for Classroom Teachers, December 8-9, Roanoke.
2. Analyze 4th and 8th grade (1977-78) SRA data by school divisions. Emphasis will be placed on providing technical assistance to those school divisions scoring low on the experimentation skill cluster.
3. Develop and distribute guidelines for energy education, K-12.
4. Distribution of Program Goals and Objectives for Elementary Science.
5. Develop assessment instruments based on the Program Goals and Objectives for Elementary Science.
6. Seek funding for a comprehensive study of the status of elementary science in Virginia.
7. Continued technical assistance in the area of environmental education.

These planned activities are in addition to the usual workshops provided by the Science Education Staff. In addition, the Science Education Staff has submitted a proposal to the National Science Foundation. If approved, this will provide funds for the formation of fifty, four-person, K-12 Science Information Teams, as an additional method to improve communications among the science education community.

Summary: The current status of elementary science in Virginia is certainly better than 10 years ago, but some aspects still need to be addressed. The use of "process science" programs and "hands on" activities have increased greatly since 1972. Although SRA scores have been climbing slowly, the low experimentation sub-test scores need to be examined. Additional assessment instruments need to be made available. The elementary science accreditation standards need to be further strengthened and means of accurate data collection have to be developed.

The cry for "back to the basics" needs to be tempered with the thought that, "Although reading, communication, and computational skills are necessary, they are not sufficient for a quality education.